REMARKS

Status of the Claims

Claims 1-8 were pending in this application. With this amendment, the applicants have amended claims 1, 6, 7, and 8 and have added claim 13. Thus, claims 1-8 and 13 are the pending claims in this application.

Summary of the Office Action

In the Office Action dated October 29, 2002, the specification was objected to because the abstract of disclosure repeats the information given in the title. Claims 1-8 were objected to, because in the preliminary amendment filed August 7, 2000, the claims were submitted in marked up form without an accompanying version of the claims in a clean format. Claims 1-8 were rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failure to particularly point out and distinctly claim the subject matter the applicants regard as the invention. Claims 1-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn (US 4,912,776) in view of Frederiksen et al. (WO 97/43528). Claims 1-4 were also rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn '776 in view of Yavuz et al. (US 6,274,107). Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn '776 in view of Frederiksen '528 and Yoshida et al. (US 5,534,237). Claims 5 and 6 were also rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn '776 in view of Yavuz '107 and Yoshida '237. Claim 8 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn '776 in view of Frederiksen '528 and Twigg et al. (US 6,294,141). Claim 8 was also rejected under 35 U.S.C. § 103(a) as being unpatentable over Alcorn '776 in view of Yavuz '107 and Twigg '141.

Objections to the Specification

In response to the Examiner's requirement to correct the abstract of disclosure, the applicants have amended the abstract accordingly herewith. Therefore, the applicants believe the application is in compliance with the rules

and submit that this objection has been overcome. Withdrawal of this objection is respectfully requested.

In response to the Examiner's requirement that the claims be submitted in a clean format, the applicant has included in this amendment, as Appendix A, a clean copy of the claims incorporating the revisions made by the preliminary amendment filed August 7, 2000. Accordingly, with the inclusion of a clean copy of the claims, the applicants submit that this objection has been overcome. The applicants respectfully request withdrawal of this objection.

Rejection Under 35 U.S.C. § 112, second paragraph

Claims 1-8 stand rejected under 35 U.S.C. § 112, second paragraph as indefinite for failure to particularly point out and distinctly claim the subject matter the applicants regard as the invention. Specifically, the Examiner noted that claim 1 includes the term "improved" which is a relative term that renders the claim indefinite and that the phrase "the NO_2 content" lacks antecedent basis. The Examiner also stated that in claim 6 the phrase "said gas cooling means" lacks antecedent basis. Finally, the Examiner pointed out that in claim 8 the phrase "the exhaust gas after-treatment system" lacks antecedent basis. Claims 1, 6, and 8 have been amended in response to this rejection. Accordingly, the applicants respectfully request withdrawal of this rejection.

Rejection Under 35 U.S.C. § 103 (a)

Claims 1-8 stand rejected under 35 U.S.C. § 103 (a). Specifically, the Examiner indicates that the claimed invention is unpatentable over Alcorn '776 in combination with Frederiksen '528 or Yavuz '107, further in view of Yoshida '237 with respect to dependent claims 5 and 6, and Twigg '141 with respect to dependent claim 8.

At the outset, the applicants have amended independent claims 1 and 7 of this application to clearly recite the specific order of placement of the components of the system of the present invention. In particular, claims 1 and 7 now recite: An oxidation catalyst; a particulate trap *downstream* of the oxidation catalyst; injection means for injecting reductant fluid *downstream* of the particulate trap; and an SCR catalyst *downstream* of the injection means. Support for these amendments to the claims is found in the specification at, for example, page 1, line 29 through page 2, line 2 (see "in order" at page 1, line 31), page 2, lines 24-31, page 4, lines 22-30, and page 6, lines 18-23. In addition, to emphasize the nature of this invention as *selective* catalytic reduction, claims 1 and 7 have been amended to recite that the reductant fluid used in the present invention is "NH_3" or "urea." Support for the "urea" designation can be found in the specification at page 3, line 21.

Claims 1-4 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Alcorn '776 in view of Frederiksen '528. On page 4 of the Office Action, it is noted that Alcorn '776 discloses an SCR system for treating NO_x in exhaust gas including an oxidation catalyst for oxidizing NO to NO_2 and, downstream of the oxidation catalyst, a source of ammonia and an SCR catalyst for reducing NO_2 to nitrogen. The Examiner recognized in the Office Action that Alcorn '776 does not disclose the use of a particulate filter.

The Office Action suggests that it would have been obvious for one of ordinary skill in the art at the time the invention was made to use the particulate filter as disclosed in Frederiksen '528 in the SCR exhaust gas treatment system of Alcorn '776. Frederiksen '528 discloses a combined silencer-purification system wherein exhaust gases are conveyed through a monolith bypass in a flow

direction, redirected back through the monolith in the opposite direction, and finally, directed through the monolith again in the initial flow direction. Frederiksen '528 discloses that the monoliths may consist of up to three types of purification elements, which are:

> placed one after the other, in the general flow direction of the exhaust gas, each monolith performing one of the following purification processes: (A) Selective Catalytic Reduction (SCR) by ammonia of NO_x in the gas, (B) catalytic oxidation of hydrocarbons and CO in the gas, and (C) removal of soot particles in the gas by filtration in the gas through the porous walls of a monolithic block in which every second channel is plugged at the opposite ends of the channels in the block. The order will typically be that process (A) comes first, while (C) may follow (B), or (B) may follow (C).

See specification at page 17, lines 1-13. As such, this portion of Frederiksen '528 discloses that the injection of NH_3 and contact of the gas with an SCR catalyst occurs upstream of the filter and the oxidation catalyst. Thus, this particular embodiment of the invention of Frederiksen '528 is in direct opposition to the system as disclosed in Alcorn '776. As such, the proposal for modifying the prior art in an effort to obtain the present invention destroys the intended function of the prior art.

Moreover, if one were to make the combination of prior art references using this embodiment of Frederiksen '528, one would place the filter downstream of the SCR catalyst based on the placement of "(A)" first, as called for in this embodiment. Thus, even after the combination, not all of the limitations of the invention now claimed by claims 1 and 7 would be met, in that the combination fails to suggest "an injection means for said reductant fluid located downstream of said particulate trap and an SCR catalyst, wherein said SCR catalyst is located downstream of said injection means." Therefore, the third and final prong of the basic requirements of a *prima facie* case of obviousness, namely, that the prior art references when combined must teach or suggest all of the claim limitations, has not been met with respect to these claim limitations. See MPEP § 2143.

For completeness, the applicants note that Frederiksen '528 also discloses that process (A) could follow (B) or (C). See Frederiksen at page 19, lines 7-14.

Consequently, Frederiksen '528 discloses that the SCR catalyst may be downstream of either the oxidation catalyst or the wall-flow filter (depending upon the embodiment). Figures 8, 9, and 10 of Frederiksen '528 show such embodiments of the invention wherein process step (A) "could be performed in the second of the two separate catalyst steps" and where nozzles 38 are placed close to the outlet of the preceding catalyst in order to inject the reducing agent (NH_3). Figures 8, 9, and 10 each disclose monoliths 5i and 5ii, with monolith 5ii being an SCR catalyst. Accordingly, monolith 5i would be *either* an oxidation catalyst *or* a wall-flow filter—but not both. See page 17, lines 1-12 (specifying "each monolith performing one of the following purification processes"). Thus, once again in this embodiment, even after the combination of references, the claimed invention is not satisfied, as the combined references do not result in the particulate trap being "located downstream of said oxidation catalyst" and the injection means being "located downstream of said particulate trap" as called for by the claims. Specifically, if one were to specify that monolith 5i is the trap, then the trap is not downstream of the oxidation catalyst and if one were to specify that monolith 5i is the oxidation catalyst, then the injection means is not located downstream of the trap.

In sum, the amended claims recite that the filter is downstream of the oxidation catalyst, the injection means is downstream of the filter, and the SCR catalyst is downstream of the injection means. Frederiksen '528 does not provide any direction as to where to place the filter if an oxidation catalyst is also present. Because Frederiksen '528 is silent with respect to the placement of the filter when an oxidation catalyst is present, it appears that the filter could be placed either upstream of downstream of the oxidation catalyst. As such, the applicants contend that it would not have been obvious for one of ordinary skill in the art at the time the invention was made to incorporate a filter as disclosed by Frederiksen '528 into the system described in Alcorn '776 so that the filter is located downstream of the oxidation catalyst, the injection means is downstream of the filter, and the SCR catalyst is downstream of the injection means. Accordingly, the applicants respectfully request withdrawal of this rejection.

Claims 1-4 also stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Alcorn '776 in view of Yavuz '107. Specifically, the examiner

asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the filter disclosed in Yavuz '107 in the SCR exhaust gas treatment system disclosed in Alcorn '776.

Yavuz '107 discloses an oxidation catalyst for the treatment of diesel engine exhaust wherein the primary purpose of the invention is to reduce the total particulates and HC and CO content of the exhaust. The catalyst disclosed in Yavuz '107 may, in fact, function in a *non-selective, passive* manner to reduce NO_x by employing hydrocarbons as a reductant. However, Yavuz '107 does not disclose the *selective* catalytic reduction (SCR) of NO_x using NH_3 or urea as a reductant. In fact, Yavuz '107 is completely silent with respect to the use of SCR exhaust gas treatment systems utilizing NH_3 or urea. The primary purpose of the catalyst, as disclosed by Yavuz '107, is the oxidation of total particulates and HC and CO. See specification, column 4, lines 57-60. Therefore, the applicants respectfully submit that no motivation exists to combine the Alcorn '776, directed to SCR, and Yavuz '107.

Moreover, the manner in which Yavuz '107 discloses the use of a filter shows that the claimed invention is not obvious. Only at column 7, lines 5-15 does Yavuz contemplate the use of a filter, but merely in passing, by mentioning that "wall-flow carriers (filters)" may be used. See column 7, lines 5-7. This portion of Yavuz '107 is the discussion of the carrier on which the catalytic material is dispersed. The primary focus of this portion is that the carrier may be a flow-through type of carrier. As an alternative embodiment, Yavuz mentions that a wall-flow carrier (i.e., a filter) may be used to support the catalytic material. When put into this context, it is clear that there is no contemplation in Yavuz '107 to use a filter "downstream of the oxidation catalyst." The "filter" function performed by the wall-flow carrier of Yavuz '107 is integral to, not downstream of, the catalytic function. Accordingly, even if one skilled in the art would have been motivated to make the proposed combination, further modification of the combination would be required to satisfy the order of the components of the SCR system, as claimed. Accordingly, the applicants respectfully request withdrawal of the rejection.

Relevant to both rejections of claims 1-4 is the fact that the order now specified by the claims is critical to carrying out the purposes of the present invention. See MPEP § 2144.05. As mentioned at page 2, lines 24-31, the applicants "have surprisingly found that a 'pre-oxidizing' step, which is not generally considered necessary because of the low content of CO and unburnt fuel in diesel exhausts, is particularly effective in increasing the conversion of NO_x to N_2 by the SCR system." Moreover, page 4, lines 22-30 emphasize the significance of placing the particulate trap downstream of the oxidation catalyst and, by noting the relative ease of combustion in the presence of NO_2, upstream of the SCR of NO_x.

Claims 5 and 6 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Alcorn '776 in view of Frederiksen '528 or Yavuz '107 and further in view of Yoshida '237. For the reasons set forth above, the applicants respectfully assert that the present invention is not obvious in view of Alcorn '776 either alone or in combination with Frederiksen '528 or Yavuz '107 and/or Yoshida '237. The applicants respectfully request withdrawal of these rejections.

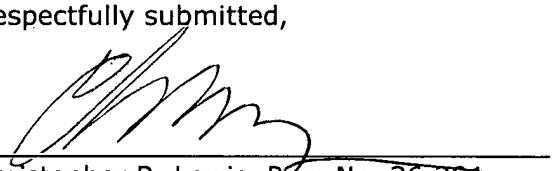
Claim 8 stands rejected under 35 U.S.C. § 103 (a) as being unpatentable over Alcorn '776 in view of Frederiksen '528 or Yavuz '107 and further, in view of Twigg '141. For the reasons set forth above, the applicants respectfully submit that the present invention is not obvious in view of Alcorn '776 either alone or in combination with Frederiksen '528 or Yavuz '107 and/or Twigg '141. The applicants respectfully request withdrawal of these rejections.

For all of the reasons set forth above, the applicants submit that the present invention is not obvious in view of Alcorn '776 in combination with Frederiksen '528 or Yavuz '107. The additional references used to reject dependent claims 5, 6, and 8, Yoshida '237 and Twigg '141, do not satisfy the limitations not satisfied by Alcorn '776, Frederiksen '528 or Yavuz '107. The applicants respectfully request withdrawal of the rejection.

CONCLUSION

The applicants submit that claims 1-8 and 13 are in condition for allowance. All grounds for objection or rejection have been overcome by the present amendment and attached appendix. For all of these reasons, the applicants respectfully submit that the objections and rejections under 35 U.S.C. §§ 112, second paragraph, and 103 (a) should be withdrawn, and allowance of the pending claims is earnestly solicited.

Respectfully submitted,



Christopher R. Lewis, Reg. No. 36,201
Attorney for Applicants

CRL/PAM/lrb
Enclosures: Version with Markings to Show Changes Made
Appendix A

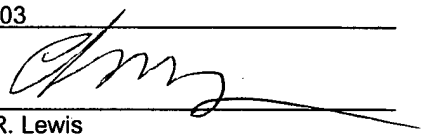
Dated: March 31, 2003

Suite 301
One Westlakes, Berwyn
P.O. Box 980
Valley Forge, PA 19482-0980
(610) 407-0700

The Assistant Commissioner for Patents is hereby authorized to charge payment to Deposit Account No. **18-0350** of any fees associated with this communication.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231 on:

March 31, 2003
Date



Christopher R. Lewis

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend the claims as follows:

1. (Twice amended) An [improved] SCR system for treating combustion exhaust gas containing NO_x and particulates, comprising an oxidation catalyst effective to convert at least a portion of NO in said NO_x to NO_2 thereby enhancing [the] NO_2 content of the exhaust gas, a particulate trap, wherein said particulate trap is located downstream of said oxidation catalyst, a source of reductant fluid, wherein said reductant fluid is NH_3 or urea, an injection means for said reductant fluid located downstream of said particulate trap and an SCR catalyst, wherein said SCR catalyst is located downstream of said injection means.

6. (Twice amended) An SCR system according to claim 5, further comprising control means such that said [gas cooling] means to cool gases is activated only when a high SCR catalyst temperature is detected or conditions are determined that are expected to lead to high catalyst temperatures.

7. (Twice amended) A diesel engine provided with an SCR system for treating combustion exhaust gas containing NO_x and particulates, said SCR system comprising an oxidation catalyst effective to convert at least a portion of NO in said NO_x to NO_2 thereby enhancing [the] NO_2 content of the exhaust gas, a particulate trap, wherein said particulate trap is located downstream of said oxidation catalyst, a source of reductant fluid, wherein said reductant fluid is NH_3 or urea, an injection means for said reductant fluid located downstream of said particulate trap and an SCR catalyst, wherein said SCR catalyst is located downstream of said injection means.

8. (Twice amended) A diesel engine according to claim 7, wherein the volume of the SCR [exhaust gas after-treatment] system is reduced and the diesel engine is light duty.

APPENDIX A

Claims in clean format from preliminary amendment filed August 7, 2000.

1. (Amended) An improved SCR system for treating combustion exhaust gas containing NO_x and particulates, comprising an oxidation catalyst effective to convert at least a portion of NO in said NO_x to NO_2 thereby enhancing the NO_2 content of the exhaust gas, a particulate trap, a source of reductant fluid, injection means for said reductant fluid located downstream of said particulate trap and an SCR catalyst.

2. An SCR system according to claim 1, wherein the reductant fluid is NH_3.

3. (Amended) An SCR system according to claim 1, wherein the oxidation catalyst is a platinum catalyst carried on a through-flow honeycomb support.

4. (Amended) An SCR system according to claim 1, wherein the particulate filter is a wall-flow filter.

5. (Amended) An SCR system according to claim 1, further comprising means to cool gases upstream of the SCR catalyst.

6. (Amended) An SCR system according to claim 5, further comprising control means such that said gas cooling means is activated only when a high SCR catalyst temperature is detected or conditions are determined that are expected to lead to high catalyst temperatures.

7. (Amended) A diesel engine provided with an SCR system for treating combustion exhaust gas containing NO_x and particulates, said SCR system comprising an oxidation catalyst effective to convert at least a portion of NO in said NO_x to NO_2 thereby enhancing the NO_2 content of the exhaust gas, a particulate trap, a source of reductant fluid, injection means for said reductant fluid located downstream of said particulate trap and an SCR catalyst.

8. (Amended) A diesel engine according to claim 7, wherein the volume of the exhaust gas after-treatment system is reduced and the diesel engine is light duty.

9. (Amended) A method of reducing pollutants, including particulates and NO_x, in a gas stream, comprising passing said gas stream over an oxidation catalyst under conditions effective to convert at least a portion of NO in the gas stream to NO_2 thereby enhancing the NO_2 content of the gas stream, removing at least a portion of said particulates in a particulate trap, reacting trapped particulate with NO_2, adding reductant fluid to the gas stream to form a gas mixture downstream of said trap, and passing the gas mixture over an SCR catalyst under NO_x reduction conditions.

10. A method according to claim 9, wherein said gas stream is the exhaust from a diesel, GDI or CNG engine.

11. (Amended) A method according to claim 9, wherein the gas stream or gas mixture is cooled before reaching the SCR catalyst.

12. (Amended) A method according to claim 9, wherein the NO to NO_2 ratio of the gas mixture is adjusted to a level pre-determined to be optimum for the SCR catalyst, by oxidation of NO over said oxidation catalyst.